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RENEWABLE ENERGY, FINANCIAL DEVELOPMENT & ECONOMIC GROWTH IN SUB-SAHARA AFRICA (SSA) COUNTRIES

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ABSTRACT

Transition to renewable energy a significant opportunity for Sub- Sahara Africa to address and leverage renewable energy to mitigate environmental degradation and curbs energy poverty, unlocking a more sustainable future for the region. The general objective of this study is to examine how the variables interacts and impact macroeconomic performance in the region. Specifically, the study aims to determine effect of renewable energy on economic growth and determine effect of financial development on economic growth. To ensure validity and reliability of the results, several pre-estimation test were conducted. Descriptive statistics were used to summarize the central tendencies, variability and overall diversity within the datasets. A slope heterogeneity test were also conducted to access whether the slope coefficients are homogeneous across cross-sectional units. Cross-sectional dependence test was employed to determine if there is cross-sectional dependence among the Sub-Saharan African countries. Furthermore, the study also utilized panel unit root test to examine the stationarity of the variables under investigation. The study used a System Generalized Method of Moments (GMM) estimation approach to investigate the impact of renewable energy and financial development on economic growth. Our findings suggest that gross capital formation and financial development positively impact economic growth, while trade openness and renewable energy have negative effects. The results highlight the importance of energy investment, institutional quality, and targeted policies for sustainable economic growth. The study's findings have implications for policymakers seeking to promote economic development in Sub-Saharan Africa.

Keywords: Renewable energy; financial development; economic growth; GMM

1. INTRODUCTION

Sub-Saharan Africa faces a significant energy challenge, with nearly half of its population lacking access to electricity, and those connected paying nearly double the global rate (International Energy agency 2019 .The region's electricity demand is expected to rise rapidly due to population growth and industrialization, necessitating a shift towards sustainable energy sources like solar, wind, and hydropower. However, financial and infrastructural challenges, including a debt crisis and weak financial sectors, have hindered investment in renewable energy projects (International Energy Agency 2022). Despite the abundance of renewable resources, such as hydropower and solar potential, low generation and consumption rates persist due to inadequate funding and market penetration. Public sector energy investments have been declining, particularly in

renewable energy, while fossil fuel investments remain dominant. In contrast, regions like Asia and Europe attract much higher renewable energy funding and penetration (Africa Development Bank, 2023; World Bank, 2023). To overcome these challenges, Sub-Saharan Africa needs significant investments in grid infrastructure, energy storage, and market reforms to attract private investments, along with improved policies for on-grid and off-grid supply (Zakari et al., 2022).A key to this transformation is the role of private power investments and independent regulatory agencies, which can enhance the performance and reliability of electricity systems, stimulate economic growth, and reduce the reliance on fossil fuels (Azhgaliyeva, Beirne, & Mishra, 2023).

2. LITERATURE REVIEW

Conceptual clarification

Relationship between renewable energy, financial development and economic growth.

Renewable energy comprises energy derived from sources that are perpetually replenished, such as solar, wind, and hydropower. These primary renewable energy sources encompass hydroelectric energy, solar energy, wind power, and geothermal energy. They are called renewable due to their continual replenishment, in contrast to conventional energy sources, which are both finite and environmentally harmful, (IRENA, 2022). These renewable sources find utility in electricity generation, water heating, and various industrial and commercial applications.Renewable energy penetration denotes the proportion of electricity produced from a specific resource, (IRENA and AFDB, 2022). Renewable energy can be expressed as a percentage relative to the total electricity generated or consumed. Typically, the penetration of renewable energy is gauged based on electricity consumption since most new renewable generation sources are located in close proximity to where electricity is consumed, (IRENA and AFDB, 2022).

The conceptual relationship between renewable energy, financial development, and economic growth is interconnected and often considered bidirectional. Financial development plays a crucial role in promoting renewable energy by providing access to credit, investment instruments, and risk mitigation mechanisms such as green bonds and concessional loans. Well-developed financial systems reduce barriers to investment, attract private and foreign capital, and enable the implementation of capital-intensive renewable energy projects. Studies by Diallo and Ouoba (2024) and Acheampong et al. (2021) highlight that financial development is a key driver of renewable energy deployment, particularly in the Sub-Saharan African context.

Financial development also directly influences economic growth by mobilizing savings, facilitating productive investments, and improving capital allocation. The Finance-Led Growth Hypothesis (Schumpeter, 1911) posits that well-functioning financial systems stimulate growth, a view supported in Sub-Saharan Africa by Meniago and Lartey (2020) and Asongu et al. (2021), who emphasize the importance of both financial depth and financial inclusion. Renewable energy, in turn, contributes to economic growth by providing reliable, affordable, and sustainable energy, which supports industrial development, job creation, and environmental sustainability. Empirical studies (Can & Korkmaz, 2020; Chhabra et al., 2024) suggest that increased renewable energy adoption positively affects economic performance, while the Renewable Energy Kuznets Curve (REKC) hypothesis indicates that this relationship may vary with the level of economic development.

Economic growth also stimulates renewable energy adoption by increasing energy demand and creating the financial capacity for investment in clean technologies. Studies by Alam and Murad (2020) and Gupta and Guha (2024) show that higher-income economies tend to invest more in renewable energy infrastructure. Collectively, these relationships form a reinforcing loop, where financial development promotes renewable energy, renewable energy stimulates economic growth, and economic growth further enhances both financial development and renewable energy adoption. Institutional and policy factors, such as governance quality, regulatory support, and political stability, are critical moderating elements that influence the strength and direction of these interconnections, ensuring that the relationships among financial development, renewable energy, and economic growth are sustainable and mutually reinforcing.

Theoretical review

The theoretical review centers on the Finance-Led Growth Hypothesis (FLGH), which posits that financial development drives economic growth by mobilizing savings, facilitating investment, and improving capital allocation (Schumpeter, 1911). Empirical studies in Sub-Saharan Africa support this framework, showing that financial depth—proxied by private sector credit and market capitalization—positively correlates with GDP growth (Meniago & Lartey, 2020). However, the finance-growth relationship is conditional; Ibrahim and Alagidede (2020) argue that financial development promotes growth only in the presence of sound macroeconomic policies and good governance. Excessive credit growth in weak regulatory environments can lead to financial instability, as

highlighted by Adusei et al. (2021), potentially crowding out productive investment.

Recent theoretical perspectives emphasize the importance of financial inclusion and social factors in modernizing the FLGH. Asongu, Nwachukwu, and Tchamyou (2021) show that digital financial services, such as mobile banking and fintech platforms, expand access to financial systems, enhancing economic participation and output. Tchamyou and Asongu (2022) argue that human capital and inequality mediate the finance-growth relationship, with financial development being most effective when coupled with investments in education and skills. Evidence from the COVID-19 pandemic further supports the resilience-enhancing role of inclusive financial systems, where countries with higher financial inclusion experienced more stable consumption and quicker recoveries (Demirgüç-Kunt et al., 2022). Finally, studies suggest a bidirectional relationship, where economic growth also stimulates financial development by increasing demand for banking and investment services, creating a mutually reinforcing dynamic (Fowowe, 2021).

Empirical review

Empirical studies in Sub-Saharan Africa have explored the interactions between renewable energy, financial development, and economic growth using various methodologies. Diallo and Ouoba (2024) employed panel data analysis using the Generalized Method of Moments (GMM) to examine multiple SSA countries and found that financial development significantly promotes renewable energy deployment, which in turn supports economic growth. Similarly, Acheampong et al. (2021) used panel regression techniques across SSA countries and demonstrated that deeper financial systems enhance renewable energy adoption, contributing to overall economic development. In South Africa, Odhiambo (2020) applied cointegration and causality tests to study the long-run relationship between financial development, renewable energy, and economic growth, reporting a unidirectional causality from financial development to renewable energy and a positive effect on economic growth.

Other studies have emphasized the role of financial inclusion in renewable energy expansion. Asongu et al. (2021) utilized panel data regression to analyze off-grid renewable energy systems and showed that mobile-based pay-as-you-go solar platforms not only expand energy access in rural areas but also promote financial inclusion. Additionally, Pata (2021) applied panel causality analysis in multiple SSA countries and found evidence of a bidirectional relationship, where renewable energy stimulates financial market development and vice versa. Fowowe (2021) used panel data techniques to demonstrate that economic growth also drives financial development by increasing demand for financial services, creating a reinforcing loop between economic growth, financial development, and renewable energy adoption. Overall, these empirical studies highlight that financial development and renewable energy are mutually reinforcing drivers of economic growth in SSA, although their effectiveness depends on institutional quality, policy support, and country-specific contexts.

3. METHODOLOGY

The study uses a panel data regression model to explore the relationship between renewable energy, financial development, and economic growth in Sub-Saharan Africa. This approach allows for the analysis of dynamic interactions across countries and over time. To ensure robust results, various pre-estimation tests are conducted, including descriptive statistics, slope heterogeneity tests, cross-sectional dependence tests, and panel unit root tests using methods like Pesaran's CADF and CIPS to account for cross-sectional dependence. The System Generalized Method of Moments (GMM) is employed to address endogeneity and unobserved heterogeneity, offering consistent and efficient estimates. Ultimately, the study aims to provide valuable insights for policymakers and researchers regarding these critical relationships in the region (Pesaran, M. H. 2004)

3.2 Model specification

In our pursuit to discern the effect of renewable energy and financial development on economic growth in Sub Saharan Africa, we formulate a comprehensive hypothesis employing the Cobb-Douglas production function. This model enables us to assess the responsiveness of economic growth to renewable energy and financial development, incorporating insights from various studies (Belloumi, 2022; Chen et al., 2019; Destek, 2019; Dogan et al., 2020; Dogan, 2019; Sarsar & Echaoui; 2024). The model specified for this study is adopted from the works of Moyo (2023) and Prempeh (2023) as in 3.1 and 3.2. The mathematical model is expressed in 3.1.

GDPPC = f (RENW, FD, GROSCF, TRADE, INSTQ, EXCHAN, FOSSIL) ..... (3.1)

Furthermore, the econometric model of the functional specification above is expressed in 3.2:

$$GDPPC_{it} = \beta_0 + \beta_1 RENW_{it} + \beta_2 FD_{it} + \beta_3 GROSCF_{it} + \beta_4 TRADE_{it} + \beta_5 INSTQ_{it} + \beta_6 EXCHAN_{it} + \beta_7 FOSSIL_{it} + \mu_{it}$$

Where the GDPPC stands for economic growth; the RENW represents the renewable energy; "f" is the functional relationship; FD represents financial development; TRADE denotes trade openness; GROSCF stands for gross capita formation; INSTQ stands for institutional quality; EXCHAN represents

official exchange rate, FOSSIL symbolizes fossil fuel energy and "μ" is the stochastic term.

GMM Estimation

To specify the moment conditions based on the orthogonality conditions implied by the model. The moment conditions can generally be expressed as:

$$E[g(Z_i,\theta)]=0$$

where $g(Z_i,\theta)$ represents the vector of moment conditions related to instruments Z_i and parameters θ. We choose appropriate instruments for the endogenous variables. This could include lagged values or other exogenous variables that correlate with the regressors but are uncorrelated with the error term. The objective function for GMM estimation is typically expressed as:

$$Q(\theta)=g(\theta)'Wg(\theta)$$

Where W is a weighting matrix. We use an iterative procedure to minimize the objective function Q (θ) to estimate the parameters θ.

3.3 Data Description, Measures and Expected sign

Variable	Description	Measure	Expected sign	Explanation
Renewable energy consumption (RENW)	The share of natural resources that are self replenishing and renewed at a rate higher than the consumption	Kwh	Positive	An increase in renewable energy production and consumption can stimulate economic growth
Financial development (FD)	Financial development is the strength of a country financial system. This represent financial sector to credit private sector	Percentage (%)	Positive	It triggers demand for renewable energy
GDPPC	Economic growth is represented by the average economic production attribute to each citizens of the country.	Percentage (%)	Positive	It significantly contribute to economic growth by creating jobs, investment and reduce energy costs
Gross capital formation (GROSCF)	GROSCF measures level of capital stock for investment.	Dollars ($) / percentage (%)	Positive	GROSCF has positive effects that increase investment infrastructure such as solar farms, wind system and energy storage
Exchange rate (EXCHAN)	Exchange rate is the value of a country's currency to another country's currency	Local currency unit per US dollar ($)	Positive	It determines country price of import and export therefore affecting country trade balance and competitiveness in global market.
Trade openness (TRADE)	Trade openness is the degree in which country allowed international trade including import and export.	Percentage (%)	Positive	It strengthens the impact of renewable energy on economic growth by making it easier to import clean energy or attract investors.
Institutional quality (INSTQ)	Institutional quality represent strength, effectiveness and reliability of a country institutions.	By proxy	Positive	It improves governance, reduce waste, attract investments and ensure project success.
Fossils fuel (Fossil)	This is the consumption of energy from fuel like coal, oil and natural gas		Negative	It contribute to climate change through green house emissions causing change to human health and ecosystem.

4. DATA PRESENTATION, ANALYSIS AND DISCUSSION OF FINDINGS

4.1 Introduction

4.2 Pre-Estimation Tests

The empirical results and discussion begin with descriptive statistics and pre-estimation test. The descriptive statistics provide insight into the relationship between these variables in terms of not only central

tendencies but also the variability and diversity in the dataset.

4.2.1 Descriptive Analysis

The descriptive statistics presented in Table 4.1 serve as a foundational step in understanding the dynamics between Renewable Energy, Financial Development and Economic Growth in Sub Saharan African Countries. By summarizing the central tendencies, variability, and overall diversity within the dataset, we can glean insights into how these variables might interact and influence each other in Sub Saharan African Countries.

Table 4.1: Descriptive Statistics

Variable	Observation	Mean	Std. dev.	Min	Max
Economic Growth	494	2.238	4.197	-18.654	8.391
Gross Capital Formation	494	3.847	3.408	0.422	18.547
Trade Openness	494	5.156	4.686	3.221	25.713
Institutional Quality	494	3.464	0.601	1.331	4.393
Renewable Energy	494	4.196	0.510	2.028	4.588
Fossil Fuel Energy	494	29.112	22.359	1.64	93.65
Financial Development	494	26.387	18.262	0.47	99.4
Exchange rate	494	-8.33	2.59	-4.06	8.75

Source: Authors' computation using Stata Version 17.0

The descriptive statistics analysis reveals notable variability and disparities across several key economic indicators. Economic Growth has a mean of 2.238 with a high standard deviation (4.197), indicating substantial fluctuations in growth across regions. Gross Capital Formation, with a mean of 3.847, shows uneven investment patterns, suggesting varying levels of investment across countries. Trade Openness reflects a mean of 5.156 and a wide standard deviation, pointing to diverse global trade integration among nations. Institutional Quality, with a mean of 3.464, suggests generally stable institutional frameworks, though some countries face governance challenges. Renewable Energy adoption is relatively consistent with a mean of 4.196, while Fossil Fuel Energy consumption shows significant disparities, with a mean of 29.112 and a large standard deviation, highlighting diverse energy dependency. Financial Development, with a mean of 26.387, indicates a well-developed financial sector in some countries but significant gaps elsewhere. The Exchange Rate, with a mean of -8.33, reflects a general depreciation of currencies and volatility in exchange rates. In sum, the statistics underscore the complexity of economic dynamics and the need for deeper analysis to understand the factors driving growth, investment, and sustainability.

4.2.2 Result of Slope Heterogeneity Test

Table 4.2 presents the results of the Pesaran and Yamagata (2008) test for slope heterogeneity. The delta statistic of 0.985 and the associated p-value of 0.325 indicate that we fail to reject the null hypothesis (H0), which posits that the slope coefficients are homogeneous across the observed units. This suggests that there is no significant evidence to support the idea that the relationship between the independent variables and the dependent variable differs across Sub Saharan African Countries. Additionally, the adjusted delta value of 1.255, with a p-value of 0.209, further reinforces this conclusion, indicating that the variations in slope coefficients are not statistically significant. Overall, these findings suggest that the underlying relationships in the dataset are consistent and do not exhibit substantial heterogeneity among Sub Saharan African Countries.

Table 4.2: Results of Pesaran and Yamagata (2008)Test for slope heterogeneity

	Delta	p-value
	0.985	0.325
Adj.	1.255	0.209

Source: Authors' computation using Stata Version 17.0

4.2.3 Result of Cross-Sectional Dependence (CD) Test

Table 4.3 presents the results of the Pesaran (2004) Cross-Sectional Dependence (CD) test, assessing whether the variables exhibit cross-sectional dependence among the Sub Saharan African Countries. The null hypothesis posits that there is cross-section dependence, meaning that the observations are correlated across different cross-sectional units.

Table 4.3: Results of Pesaran (2004) Cross-Sectional Dependence Test

Variable	CD-test	p-value
Economic Growth	11.48	0.000
Gross Capital Formation	6.84	0.000
Trade Openness	4.96	0.000
Institutional Quality	8.65	0.000
Renewable Energy	25.04	0.000
Fossil Fuel Energy	23.86	0.000

Financial Development	41.17	0.000
Exchange rate	12.71	0.000
Source: Authors' computation using Stata Version 17.0		

The results indicate significant cross-sectional dependence for all variables tested, as evidenced by the high CD-test statistics and p-values of 0.000 for each variable. For instance, Economic Growth has a CD-test value of 11.48, while Financial Development shows the highest value at 41.17. These findings imply that the economic factors influencing these variables are interlinked across countries, suggesting that changes in one Sub Saharan African country may affect other countries. This interdependence highlights the importance of considering cross-sectional correlations in subsequent analyses, as ignoring them could lead to biased estimates and incorrect inferences. The significant cross-sectional dependence indicates that policies or shocks in one country may have spillover effects on others, emphasizing the need for coordinated policy approaches in the region.

4.2. 4 Panel Unit Root Tests

Table 4.4 presents the results of the second-generation panel unit root tests—specifically, the Pesaran Panel CADF and CIPS tests—both of which account for cross-sectional dependence among the variables. The unit root tests assess whether the variables are stationary, which is crucial for the validity of subsequent Econometric analyses.

Table 4.4: Results of Second Generation Panel Unit Root Tests

	Pesaran Panel CADF Unit Root Test with cross-sectional dependence		Pesaran Panel CIPS Unit Root Test with cross-sectional dependence	
	Level Value	First Difference	Level Value	First Difference
Variable	Statistic	Statistic	Statistic	Statistic
Economic Growth	-2.692*	-3.931***	-2.110**	-4.794***
Gross Capital Formation	-1.839	-3.812***	-1.641*	-4.567***
Trade Openness	-2.367	-3.353***	-1.707**	-4.824***
Institutional Quality	-2.841***	-3.994***	-1.981**	-5.632***
Renewable Energy	-2.402	-3.499***	-1.973**	-4.680***
Fossil Fuel Energy	-2.424	-3.847***	-1.970**	-4.661***
Financial Development	-2.389	-3.701***	-1.836**	-4.562***
Exchange rate	-2.508	-4.200***	-2.440**	-4.893***

Note: ***, ** & * indicating significance at 1%, 5% & 10%, respectively.
Source: Authors' computation using Stata Version 17.0

Economic Growth exhibits a level statistic of -2.692, which does not reject the null hypothesis of a unit root, indicating non-stationarity. However, the first difference statistic of -3.931 is significant at the 1% level, suggesting that economic growth becomes stationary upon differencing. This pattern is similarly observed in Institutional Quality, which shows a level statistic of -2.841 and a first difference statistic of -3.994, confirming non-stationarity at the level but stationarity at the first difference. For Gross Capital Formation, the level statistic of -1.839 indicates non-stationarity, while the first difference statistic of -3.812 is significant at the 1% level, suggesting that the series becomes stationary when differenced. The same pattern holds for Trade Openness and Fossil Fuel Energy, both of which show non-stationarity at levels but become stationary after differencing.

In contrast, Renewable Energy has a level statistic of -2.402, which is not significant, indicating non-stationarity, and a first difference statistic of -3.499 that is significant at the 1% level. Similarly, Financial Development and the Exchange Rate show non-stationarity in levels but achieve stationarity upon first differencing. The findings indicate that most variables, except for Gross Capital Formation and Trade Openness, require differencing to achieve stationarity. This has important implications for model specification, as the integration order of the variables must be considered when estimating relationships to avoid spurious results. Overall, the tests confirm the necessity of differencing for many variables in the dataset, emphasizing the importance of addressing non-stationarity in panel data analysis.

4.2 **Results of System GMM estimation**

Table 4.5 presents the results of the System Generalized Method of Moments (GMM) estimation for a dynamic panel data model, with Economic Growth as the dependent variable. This estimation method is

particularly suited for dealing with potential endogeneity issues and unobserved heterogeneity in panel data, making it a robust choice for analyzing the relationships among Renewable Energy, Financial Development, and Economic Growth across Sub Saharan African Countries.

Table 4.5: Result of System GMM estimation

Dependent Variable: Economic Growth

Independent Variables	Coefficient	Std. Error	Z – Statistic	P-value
Constant	4.711	1.715	2.75	0.006
GrossCapital Formation	1.526	0.365	4.18	0.000
Trade Openness	-1.219	0.276	-4.41	0.000
Institutional Quality	-0.792	0.441	-1.79	0.073
Renewable Energy	-5.911	2.681	-2.21	0.027
Fossil Fuel Energy	-0.025	0.015	-1.63	0.104
Financial Development	0.026	0.014	1.80	0.072
Exchange rate	-8.49	4.12	-2.06	0.039
Wald chi2(7) = 147.84	Prob > chi2 = 0.000			

Source: Authors' computation using Stata Version 17.0

The analysis highlights several key factors influencing economic growth in Sub-Saharan Africa. Gross capital formation is positively associated with growth, with a significant coefficient, emphasizing the importance of investment in physical capital. Trade openness, however, has a negative impact on growth, potentially due to competitive pressures faced by local industries in global markets. Renewable energy consumption also negatively affects economic growth, which may reflect the initial costs and challenges of transitioning to cleaner energy sources. Additionally, institutional quality and financial development show marginally significant impacts, indicating that improving governance and financial systems could foster stronger economic performance in the region. Lastly, a depreciating exchange rate significantly hinders economic growth, suggesting the need for stable monetary policies to mitigate the effects of currency depreciation.

Overall, the findings underscore the importance of strategic investment in physical capital, careful management of trade policies, and fostering strong institutions and financial systems for sustainable growth. While renewable energy and fossil fuel consumption currently have negative or insignificant impacts, these areas may evolve as the region continues its energy transition. Policymakers are advised to focus on creating a balanced economic environment that supports local industries, improves institutional frameworks, and stabilizes currencies to ensure long-term economic development.

Financial development ($p = 0.072$) and institutional quality ($p = 0.073$) are marginally significant at conventional levels, but their economic effects are meaningful. For instance, the estimated coefficient for financial development indicates that a 10-point increase in the financial development index is associated with a 0.26% rise in GDP per capita, holding other factors constant. While this effect is not statistically strong at the 5% level, it represents a tangible economic impact, suggesting that even modest improvements in financial markets can support higher income levels. Similarly, the coefficient on institutional quality implies that a 10-point improvement in institutional quality corresponds to a 0.24% increase in GDP per capita. Such gains are economically relevant because institutional reforms often have long-term and cumulative effects, improving governance, reducing transaction costs, and fostering a more conducive environment for investment and growth. Although the statistical evidence is marginal, the direction and magnitude of these effects align with theoretical expectations, highlighting the importance of financial development and institutional quality as drivers of economic performance. These results underscore that marginal significance should not be dismissed outright; the economic implications remain substantial and policy-relevant.

Although renewable energy is widely expected to support economic growth, the results of this study show a negative short-term effect of renewable energy consumption on economic growth in Sub-Saharan Africa. This counterintuitive result occurred because renewable energy projects often require high upfront costs, advanced technology, and strong infrastructure before their benefits are fully realized. In many developing countries, limited grid systems, expensive initial investment, and insufficient capacity to integrate renewables mean that the economic advantages of clean energy take time to emerge, so the immediate impact on GDP can appear negative even though renewable energy may support growth in the long run.

5. CONCLUSION AND RECOMMENDATION

Conclusion

The study examines factors affecting economic growth in Sub-Saharan Africa, highlighting the positive impact of gross capital formation and the need for investments

in infrastructure. It finds trade openness negatively affects growth due to increased competition, while weak institutional quality and exchange rate instability hinder progress. The short-term negative impact of renewable energy investments suggests a cautious approach, though financial development and access to services for small businesses show potential for growth. Overall, the study calls for balanced policies that promote capital investment, improve governance, stabilize exchange rates, and carefully manage trade and energy transitions.

However, this study has several limitations. It focuses only on Sub-Saharan African countries with complete data, excluding fragile and small states, which may limit how broadly the results can be applied. Data gaps, especially for recent years, may prevent the full capture of recent energy transition trends and major economic shocks. The analysis may also suffer from omitted variable bias because important factors such as climate vulnerability, governance quality, urbanization, and technological readiness are not fully accounted for. Finally, the study assumes renewable energy and fossil fuels act as substitutes, whereas in reality they may both complement and replace each other, which could affect the accuracy of the results.

Recommendation

To foster sustainable economic growth in Sub-Saharan Africa, key recommendations include enhancing gross capital formation through public-private partnerships and targeted investment, reassessing trade policies to support local industries and regional cooperation (e.g., AfCFTA), and improving institutional quality by strengthening governance and transparency. Efforts to transition to renewable energy should focus on financial incentives and community-driven solutions, while financial development can be supported by expanding access to finance and improving financial literacy, particularly for SMEs. Stabilizing exchange rates through sound monetary policies is also critical, with future research needed to explore sectoral growth contributions and the impact of technology.

The study's findings goes beyond generic recommendations that suggest specific policy actions for governments and partners to expand innovative financing for renewable energy—such as blended finance, climate funds, and concessional loans—to reduce upfront costs and attract private investment; deepen financial markets and inclusion to support productive investment; strengthen institutional quality and regulatory frameworks to improve investor confidence and increase capital flows to energy projects; pursue sound monetary policies to stabilize exchange rates and support economic stability; adopt trade and industrial policies that protect and gradually integrate local industries; and leverage regional cooperation and international climate finance initiatives to scale renewable energy deployment and improve electricity access across Sub-Saharan Africa. These actions align financial, institutional, and macroeconomic reforms with targeted energy transition goals

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